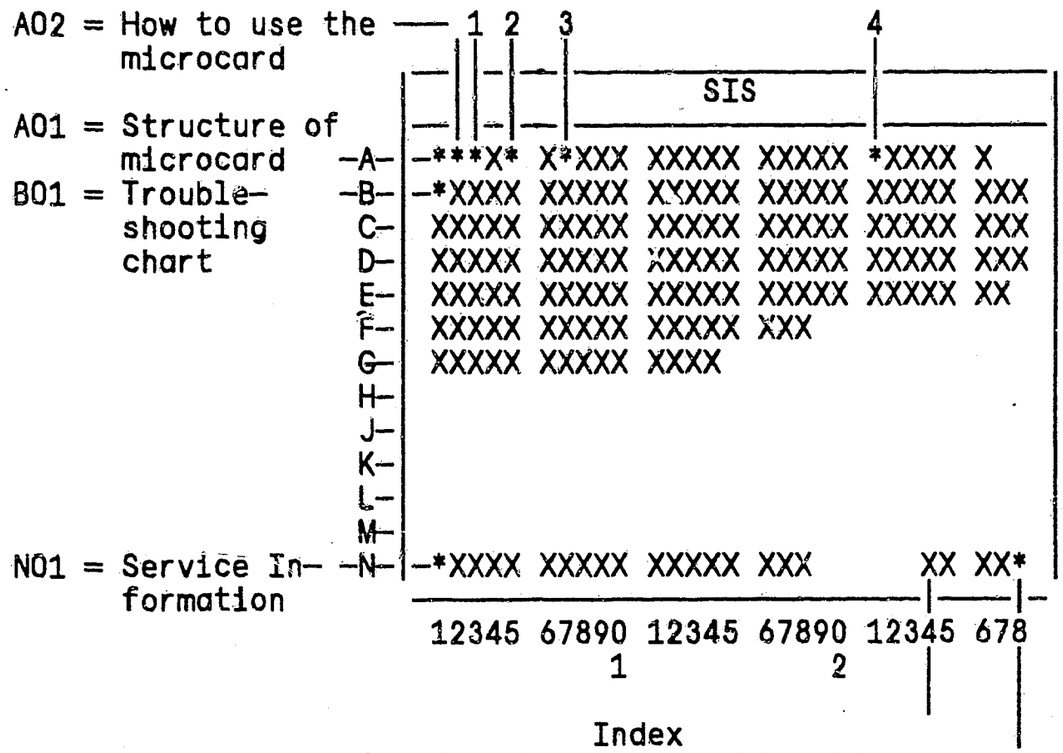
STRUCTURE OF THE MICROCARD (BASIC INSTRUCTIONS)



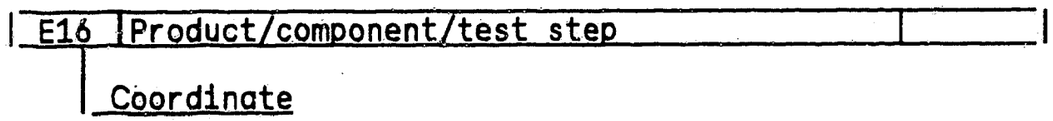
Index

N28 = Table of contents and publication information

1 = Special features
2 = Safety and precautionary measures
3 = Test equipment and tools
4 = Installation position of components

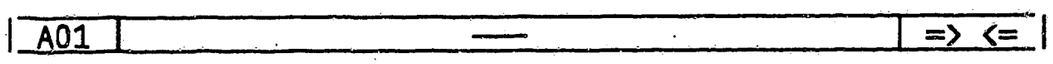
a. Read from left to right.

b. Title of micropicture (appears on each coordinate).



c. Limits of section





USING THE MICROCARD

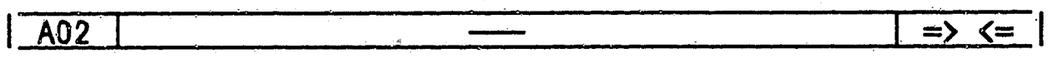
Trouble-shooting instructions:

System: EI

Descriptions, photos, terminal designations, and special features refer to the following vehicle:

Jaguar XJ 6, year of manufacture 1986
with 2.9 l 6-cylinder engine.

The basic instructions contain detailed trouble-shooting instructions. They must not be used as vehicle-specific instructions.
CAUTION! Descriptions and photographs may deviate from the vehicle-specific brief instructions.
Binding test values, terminal assignments, and special features must be taken only from the vehicle-specific brief instructions.
For brief instructions see microcard KFZ-00..



Special features

The Europe model w i t h o u t c a t a l y t i c c o n v e r t e r is equipped with electrically controlled vacuum change-over.

Components of this system are a time-limit switch, a temperature switch, a 3-way solenoid-operated valve, and a delay valve.

Function:
Lowering hydrocarbon emission values.

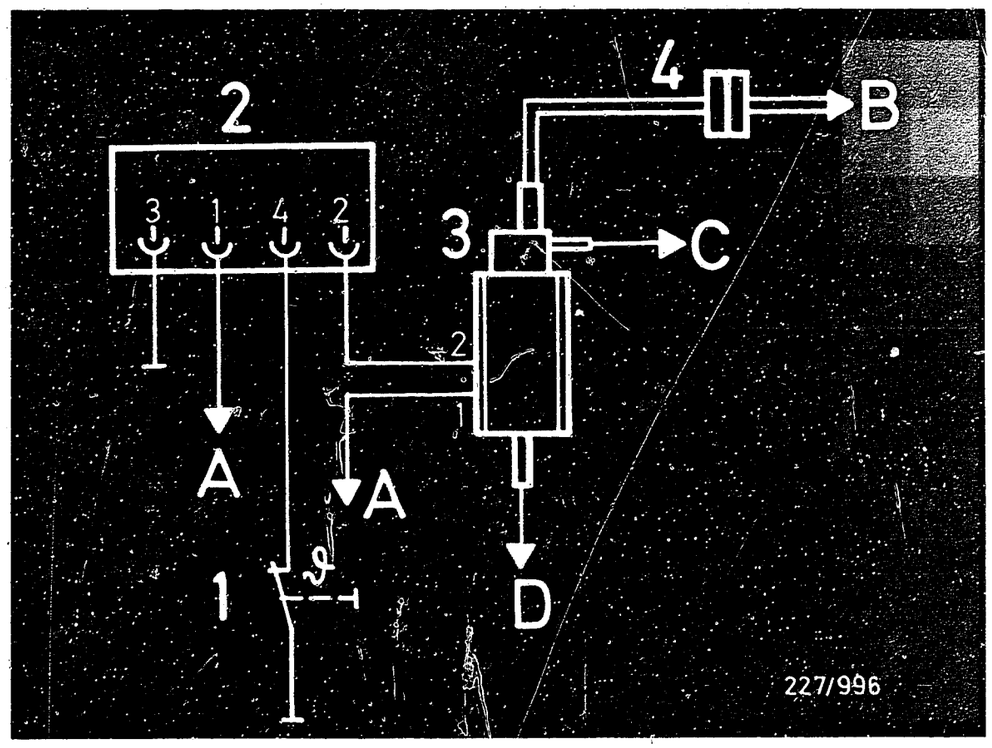
Operation:
At a coolant temperature below approx. +38°C the temperature switch is closed. The time-limit switch then actuates the 3-way solenoid-operated valve for 15 minutes, the vacuum sensor (in the EI control unit) is connected to a vacuum connection located b e f o r e the throttle valve (no vacuum when throttle valve closed). When the throttle valve is opened, the delay valve causes a slower rise in vacuum.

At a coolant temperature > approx. +45°C or after 15 minutes, the 3-way solenoid-operated valve is deprived of current.
The vacuum sensor (in the EI control unit) is now directly connected to the intake manifold.

Incorrect reading for engine speed, dwell angle, and ignition timing

For ignition systems with control unit 0 227 400 011 and ... 015 (with current limitation) there may be an incorrect reading of engine speed, dwell angle, and ignition timing at test units.

See coordinates N8 – N12 for more detailed information.



Special features (continued)

Vacuum change-over
(EU model w i t h o u t catalytic converter)

1 = Temperature switch
2 = Time-limit switch
3 = 3-way solenoid-operated valve
4 = Vacuum delay valve
A = Voltage supply +
B = To throttle-valve assembly
C = To EI control unit
D = To intake manifold

The components of this system are service parts of the Jaguar company.

SAFETY AND PRECAUTIONARY MEASURES

Always observe safety and precautionary measures in order to avoid hazards to persons and damage to the engine, the trigger box and control unit, and the ignition system.

CAUTION!
High-performance ignition system with dangerous high and low voltages!

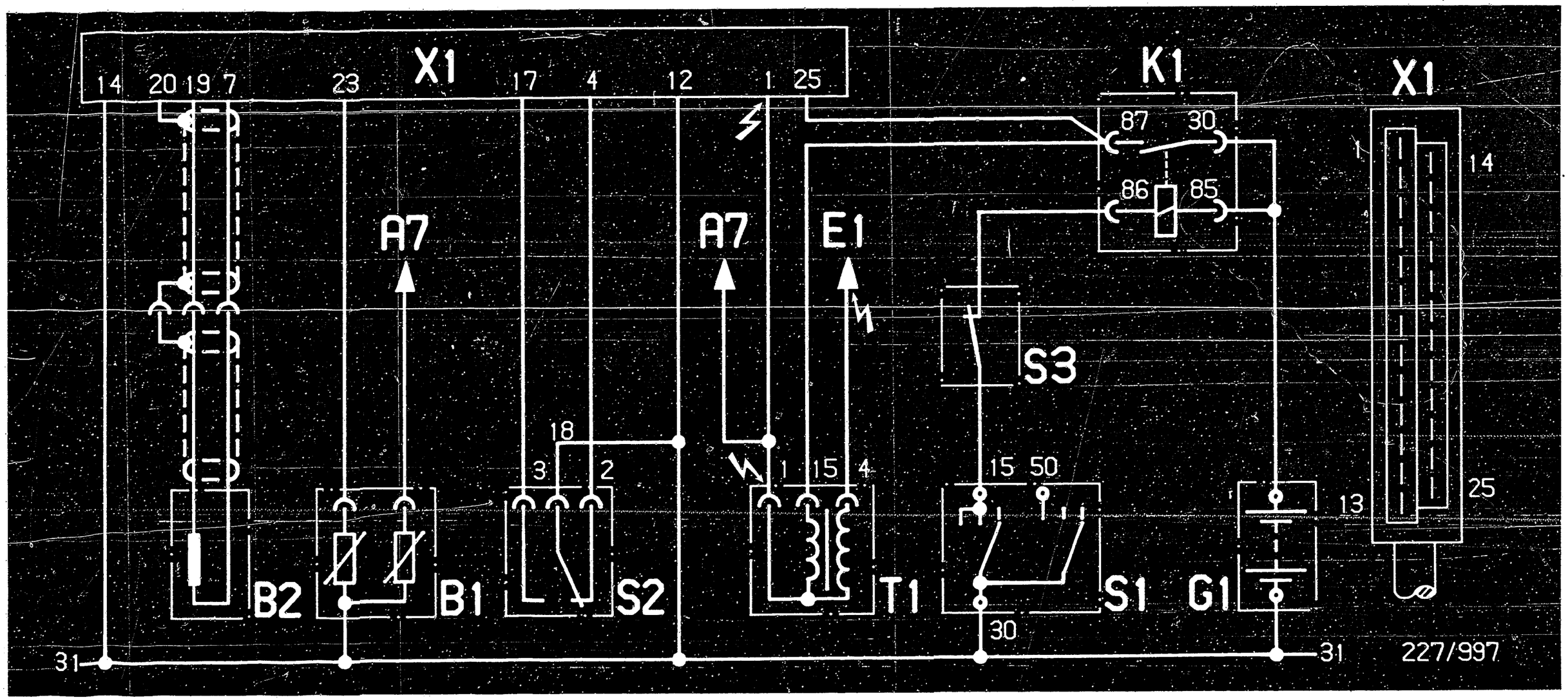
Contact with voltage-carrying parts or terminals can be fatal (on both primary and secondary sides).

In this connection it must be noted that when working on or testing the ignition system the VDE requirements, in particular VDE 0104/7.67, or the pertinent local regulations outside Germany, must be complied with.

When working on the ignition system, the ignition must always be switched off (disconnect ignition or voltage source).
Such work includes:

* Connecting engine testing devices (timing light, dwell-tach tester, ignition oscilloscope, etc.).

* Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, ignition cable, etc.).



High-voltage arrows: Caution, dangerous voltage (400 V...25 kV)

A7 = To LH-Jetronic control unit
B1 = Coolant-temperature sensor
B2 = Engine-speed reference-mark sensor
E1 = To high-voltage distributor
G1 = Battery
K1 = Supply relay
S1 = Ignition switch (switches to negative)
S2 = Throttle-valve switch
S3 = Impact switch
T1 = Ignition coil
X1 = EI control unit

Taking the example of the circuit diagram for an electronic ignition system, the hazardous points are marked with high-voltage arrows.

Safety and precautionary measures (continued)

If during testing of the ignition system or adjustments to the engine (e.g. mixture preparation) it becomes necessary to switch on the ignition (connect ignition or voltage source), the dangerous voltages mentioned occur throughout t h e e n t i r e s y s t e m.

In other words, the danger of accident exists not only at the individual parts of the ignition system, such as ignition distributor, ignition coil, trigger box, ignition harness), but also in the wiring harness (such as tachometer connection, diagnostic plug), in plug connections, and with test equipment.

Never start engine without battery being firmly connected (battery terminals bolted tight).
Do not disconnect battery from the vehicle electrical system with the engine running.

Do not use a fast charger for starting the engine.
Render starting assitance only with a second 12 V battery and jumper cables.
Caution! Due to non-uniform requirements placed by vehicle manufacturers on electronic products, we do not recommend the use of 24 V batteries for starting assistance.

When charging the battery in the vehicle or rendering starting assistance, observe the directions given in the operating instructions of the fast charger as well as those provided by the vehicle manufacturer.

Prior to charging or fast-charging the battery, disconnect it from the vehicle electrical system.

Incorrect polarity of the supply voltage, e.g. due to incorrect connection of the battery or ignition coil, can lead to irreparable damage to a control unit.

Do not connect or disconnect the wiring harness from control units or trigger-box with the ignition switched on.

Prior to exposure to temperatures above +80°C (paint-dry installation) remove control units.

Control units must be removed before electric spot welding.

SAFETY AND PRECAUTIONARY MEASURES
(continued)

* Carry out resistance measurements only with the ignition switched off or the battery disconnected (defective tester).

* When carrying out compression testing, disconnect the trigger-box plug, or connect ignition coil term. 4 f i r m l y to ground using auxiliary cable (dangerous high voltage, insulation damage to ignition coil, high-voltage distributor, ignition harness).

 N o t e:
 Auxiliary cable must be interference-suppressed to at least 2 k Ω , e.g. sleeve-type suppresor (5 k Ω) 0 356 500 001.

* The specified ignition coil (see part no.) may not be replaced by a differenct ignition coil.

* A suppression capacitor must not be connected to ignition coil term. 1.

* Ignition coil term. 1 must not be connected to ground for the purpose of theft prevention. (Ignition coil would be destroyed when "ignition on".)

* Battery + or a test lamp must never be connected to ignition coil term. 1 (would destroy trigger box).

* The ignition cable from ignition coil term. 4 to high-voltage distributor term. 4 must never be disconnected during operation.

* There must never be voltage jumps from ignition coil term. 4 to ignition coil terms. 1 and 15, as this could destroy the trigger box.

* If the polarity of the battery is incorrect, the EI control unit and ignition coil will be destroyed.

* In order to prevent the destruction of the control unit, the secondary side of the ignition system must be interference-suppressed to at least 2 k Ω , whereby the original distributor rotor of 1 k Ω must be installed (no 5 k Ω distributor rotor may be used, even with radio interference suppression).

* The leads from the engine-speed reference-mark sensor to the EI control unit must be shielded (to prevent impairment of control-unit operation).

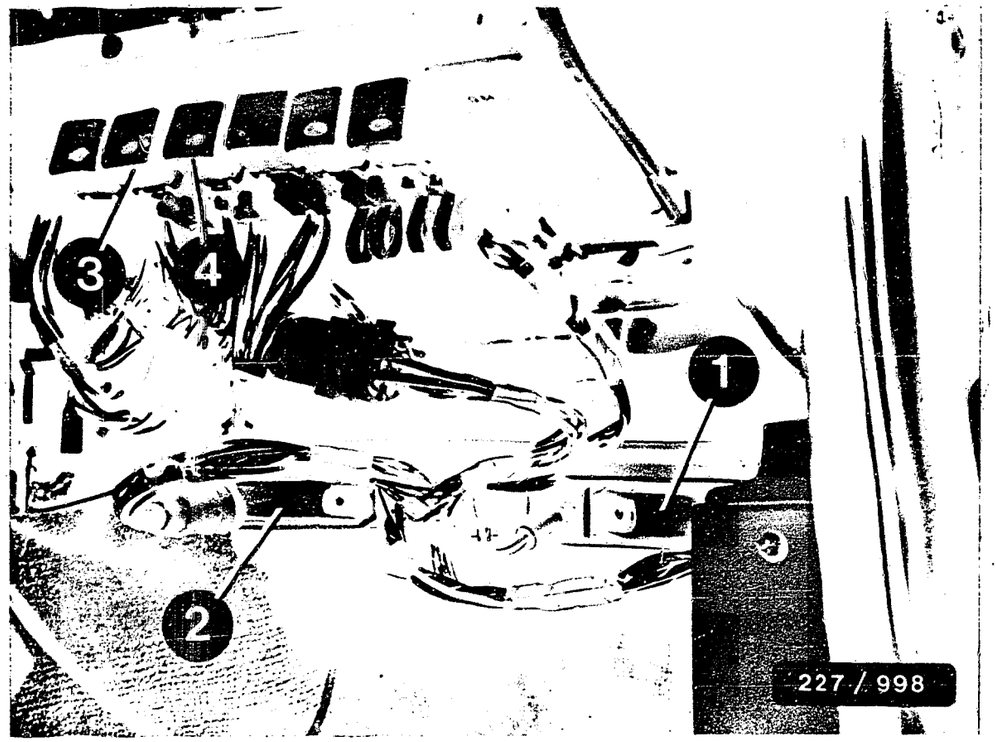
* Arcing and puncture on the high-voltage distributor cap (poor insulation) can destroy the control unit.

NECESSARY TEST EQUIPMENT AND AIDS

Motortester e.g.	MOT 201	0 684 000 201
Pulse shaper (for measuring primary voltage with MOT 201,202,400)		1 684 463 154
Ohmmeter	ETE 014.00	0 684 101 400
or e.g.	Pontavi WH2	Commercially available
Voltmeter e.g.	ETE 014.00	0 684 101 400
Thermal conduction compound		5 942 860 003
Test leads (for proper connection of test equipment to connector plugs).		KDZS 0004 and KDZS 0005
Test prods (for proper connection of test equipment to connector plugs).	red	1 684 485 035
	black	1 684 485 034
Vacuum pump e.g. from Korinth Co, Ludwig-Kloos-Str. 21 D-6450 Hanau 7 -Steinheim	Mityvac	Commercially available

User-fabricated auxiliary cable
(for bridging supply relay)
Parts required:
approx. 100 mm, 2.5 mm ^{2} cable,
2 blade terminals 8 784 480 011

For production reasons: continued on the following coordinate.



INSTALLATION POSITION OF COMPONENTS

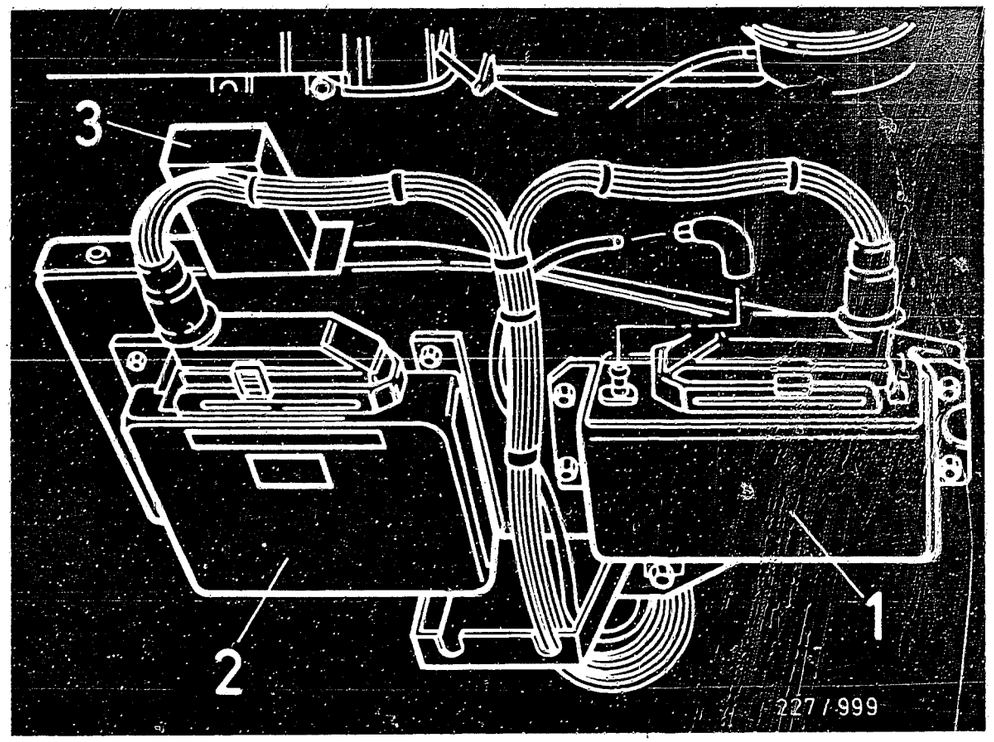
1 = EI control unit
2 = LH-Jetronic control unit
3 = Supply relay, ignition
4 = Supply relay, Jetronic

The control units for the ignition and Jetronic are positioned beneath the glove compartment.

Note on removal:

Remove lower instrument-panel trim and pull trim away downward.

Note: In a right-hand drive vehicle, the installation positioning of these components is a mirror image of that shown with the functions remaining the same.



1 = EI control unit

2 = Jetronic control unit

3 = Time-limit switch

Installation position of components (continued)

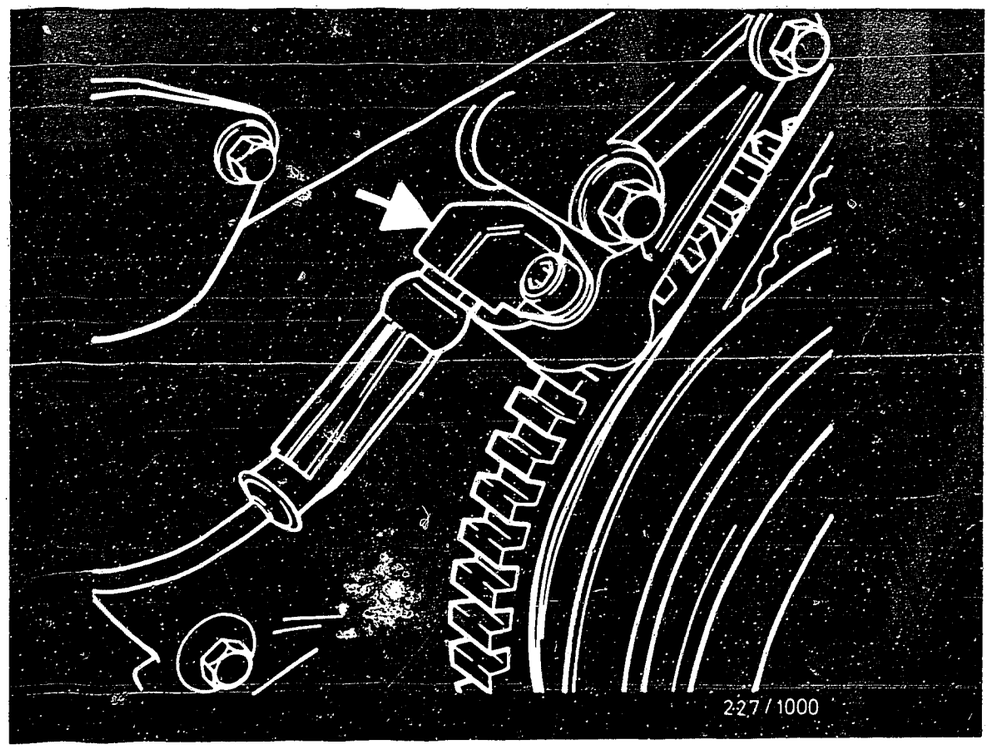
The time-lag relay is positioned close to the Jetronic control unit, see upper illustration.

Further components of the vacuum switch-over facility:

1. Temperature switch: next to the coolant temperature sensor.

2. 3-way solenoid-operated valve: at the rear end of the intake manifold.

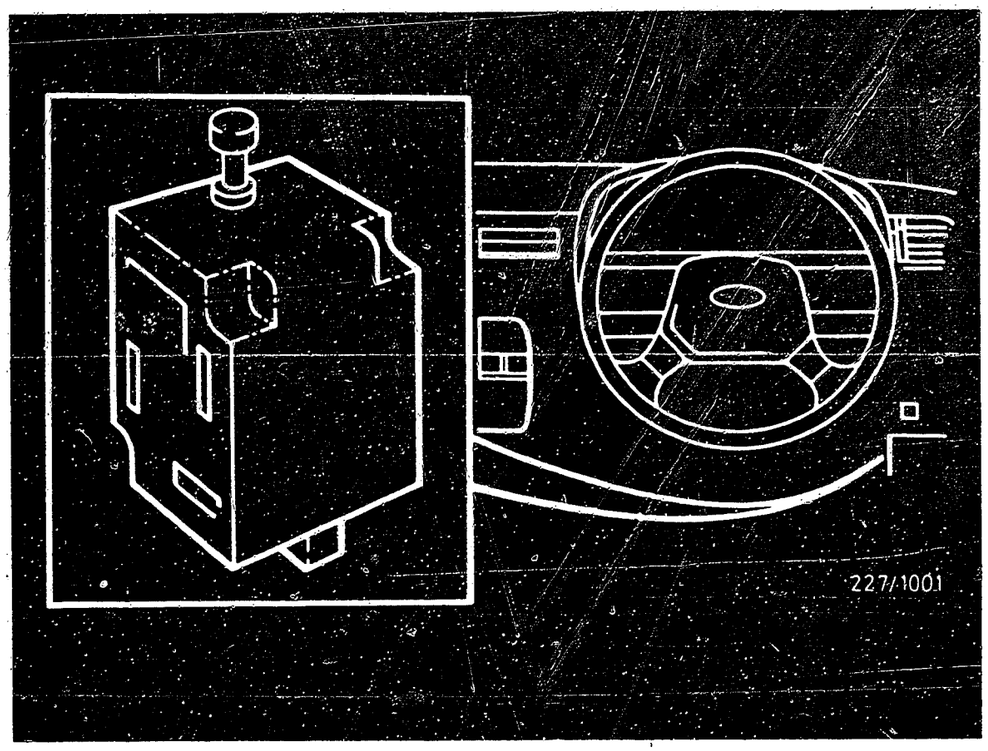
3. Delay valve: in the hose line to the throttle-valve assembly.



Installation position of components (continued)

Arrow = Engine-speed reference-mark sensor

The engine-speed reference-mark sensor is positioned at the end face of the engine behind the crankshaft pulley.



Installation position of components (continued)

The impact switch is positioned on the driver's side behind the side panelling, see upper illustration.

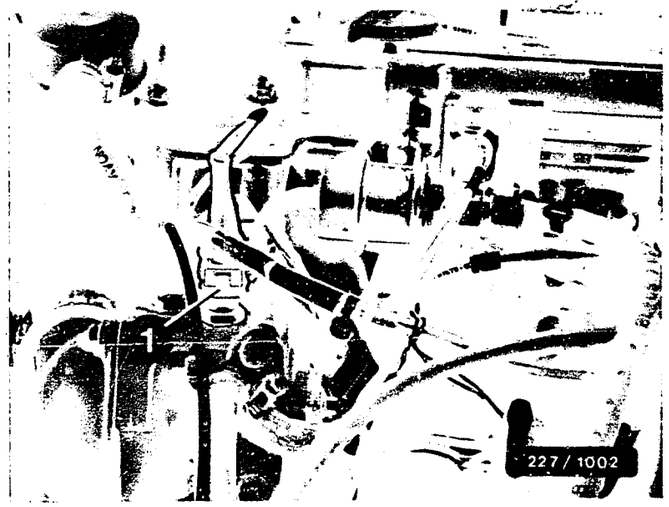
In the case of a heavy impact (accident), the impact switch interrupts the voltage supply to the ignition system and electric fuel pump.
The switch can be reset by pressing the pin on the upper side of the housing.

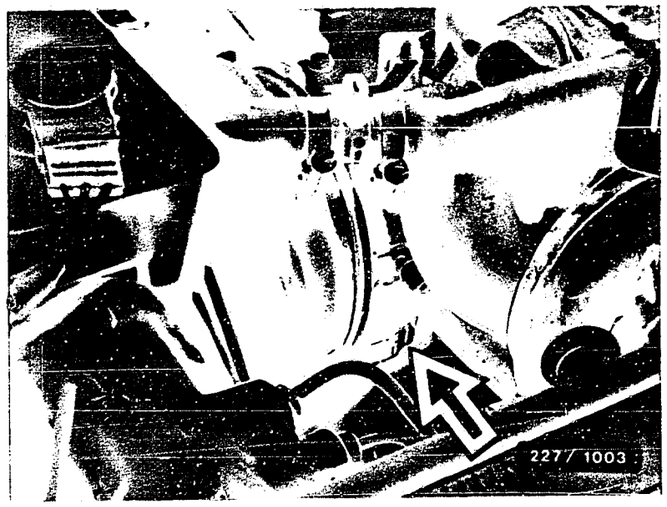
Installation position of components (continued)

The coolant temperature sensor is positioned on the thermostat housing (upper illustration)

The throttle-valve switch is positioned below the throttle-valve assembly, (center illustration) arrow

The high-voltage distributor is mounted on the right-hand side of the engine (lower illustration, 1).
The ignition coil is mounted on the right-hand inner fender, (lower illustration, 2).







HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts on coordinate B03 and contains customer complaints (fault symptoms) with several possible causes (component faulsts) in each case as well as coordinate references for detailed trouble-shooting. If no coordinate reference is given, this is a cause for which no test instructions are required.

If the customer complaint is clear, proceed with trouble-shooting in the given order of possible causes one after the other and step by step.

Always start trouble-shooting with the self-diagnosis (if applicable) or with the universal test adapter (if provided). Only then continue with the trouble-shooting chart.

If the customer complaint is not clear, check all the causes listed in the trouble-shooting chart. To prevent possible incorrect measurements, check all causes in the order given (owing to the interlinking of test steps).

If, after checking all the possible causes, the customer complaint has still not yet been rectified, then TRY installing a new specified coil or trigger box/control unit.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (continued)

The TROUBLE-SHOOTING PROGRAM contains all system and component checks mentioned in the trouble-shooting chart. It is divided into three rows of boxes.

The left-hand column contains test instructions and set values.
The center column contains instructions on trouble-shooting and fault rectification.
The right-hand column contains the illustratrations/terminal diagrams belonging to the text, with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.
After rectifying a fault repeat the test as a check.

REQUIREMENTS FOR TESTING:

- Battery fully charged
- Engine in good mechanical condition (e.g. compression, valve clearance etc.)
- Engine at operating temperature, approx. +80°C (where necessary)
- Proper seating of all plug connections of wiring harness

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems (engine speed, exhaust)
4. Poor throttle response
5. Engine missing (ignition, injection)
6. Insufficient engine power / maximum speed
7. Excessive fuel consumption
8. Engine diesels
9. Engine pings/knocks
10. Engine overheats
11. Fault lamp

										Cause (component fault)	Coord.
*		*	*	*	*	*				High-voltage side	B05
*		*	*	*	*					Ignition coil	B07
*		*								Firing sequence	—
*										Voltage, EI control unit	B09
*										Voltage, primary circuit	B11
*			*	*						Engine-speed reference-mark sensor	B13
*										High-voltage distributor	B19
*										Contact resistances	B21
		*	*	*	*	*		*	*	Coolant-temperature sensor	B23

B03 — ⟹

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies
3. Idle problems (engine speed, exhaust).
4. Poor throttle response
5. Engine missing (ignition, injection).
6. Insufficient engine power/ maximum speed
7. Excessive fuel consumption
8. Engine diesels
9. Engine pings/knocks
10. Engine overheats
11. Fault lamp

										Cause (component fault)	Coord.
		*	*	*	*	*		*	*	Throttle-valve switch, idle	B25
		*	*	*	*	*		*	*	Throttle-valve switch, full load	B27
			*		*	*				Vacuum change-over	C01
		*	*	*	*	*		*	*	Ignition timing	C07
			*			*		*	*	Vacuum sensor	C09
				*						Voltage, EI control unit	C11
				*						Voltage, ignition coil	C13
				*						Primary voltage	C15

B04 — ⟸

TROUBLE-SHOOTING PROGRAM (1)

V

Testing HIGH-VOLTAGE SIDE.

Test spark plugs, spark-plug connectors, interference-suppression resistors, H.T. ignition cables, distributor cap, distributor rotor etc. for proper function (e.g. open circuit, shunt).

Assessment e.g. using ignition oscillogram, resistance measurement and visual check.

High-voltage side O.K.?

N> Repair high-voltage side.

Y

V

Return to trouble-shooting chart B03

B05 ⟹

B06 ⟸⟹

TROUBLE-SHOOTING PROGRAM (2)

V

Test IGNITION COIL.

Visual check: remove protective cap from ignition coil and check whether plug (see illustration) is present or if any sealing compound has escaped.

Electrical test:

Primary resistance at terms. 1 and 15 (take into account resistance of test leads and prods)

Secondary resistance at terms. 1 and 4
See brief instructions for resistance values.

Is plug present, has any sealing compound escaped?

Resistance values O.K.?

N>

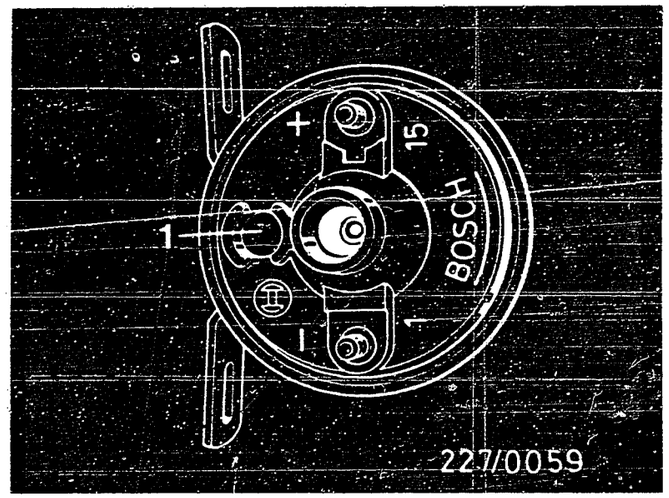
1.If there is no plug or if sealing compound has escaped, replace the ignition coil and the EI control unit.

2.If resistance values were not O.K., replace the ignition coil.

Y

V

Return to trouble-shooting chart B03



1 = Plug

B07 —— <⟹>

B08 —— <⟹>

TROUBLE-SHOOTING PROGRAM (3)

Test VOLTAGE SUPPLY,
EI CONTROL UNIT.

Disconnect the EI control-unit plug and connect voltmeter to terms. 25 (+) and 12 (-), see upper illustration
Switch on ignition.
Voltmeter should show battery voltage.

Is voltage O.K.?

N>

Switch off ignition.
Check following leads for open circuits:

1.From supply relay term. 85 to positive battery terminal.

2.From supply relay term. 30 to positive battery terminal.

3.From supply relay term. 86 via impact switch to ignition and starting switch.

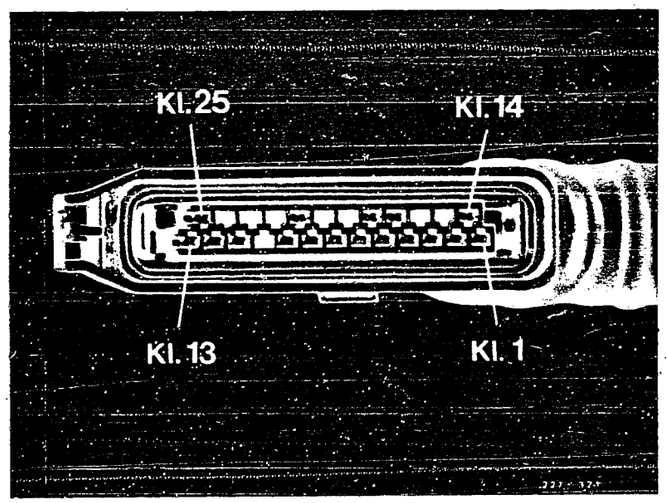
4.From supply relay term. 87 to EI control-unit plug term. 25.

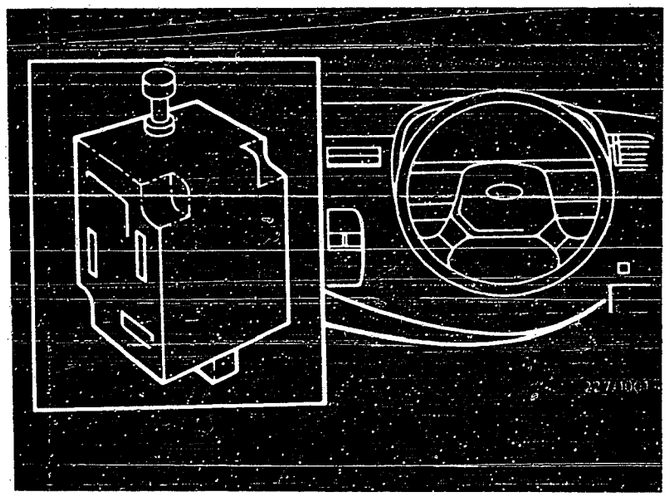
5.From EI control-unit plug term. 12 to vehicle ground.

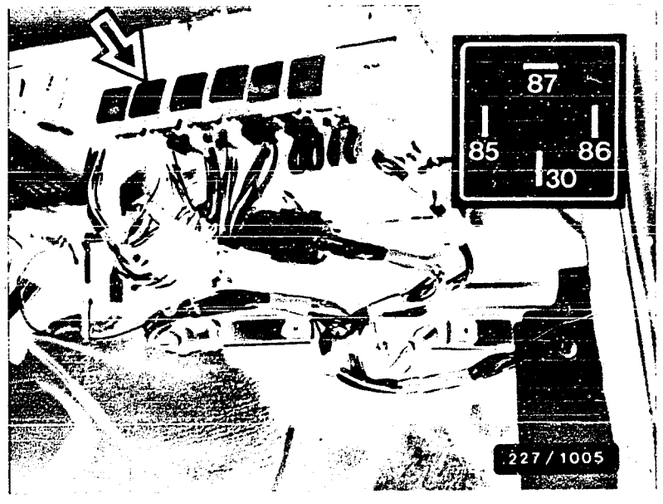
Eliminate open circuits. If there were no open circuits, replace the supply relay.

Y

Return to trouble-shooting chart B03







TROUBLE-SHOOTING PROGRAM (4)

V

Test PRIMARY CIRCUIT.

Disconnect EI control-unit plug, connect voltmeter to term. 1 (+) and term. 12 (-).
Switch on ignition.
Voltmeter should show battery voltage.

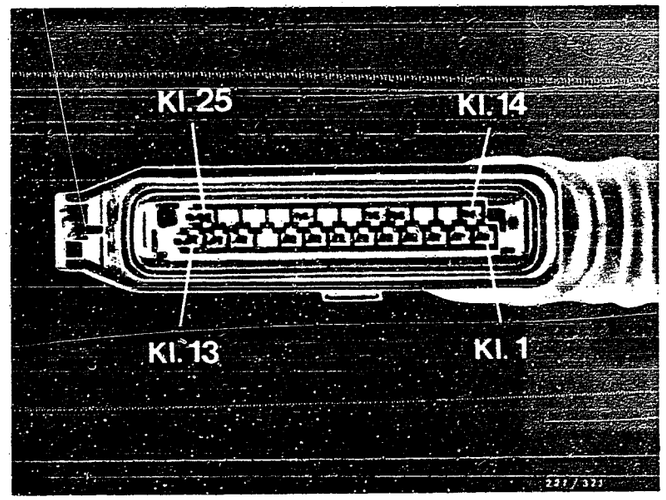
Is voltage O.K.?

N> Test supply lead from ignition and starting switch to ignition coil term. 15, primary winding of ignition coil, and lead from ignition coil term. 1 to EI control-unit plug term. 1 and ground lead term. 12 for open circuits.
Eliminate open circuits.

Y

V

Return to trouble-shooting chart B03



B11 — <⟹>

B12 — <⟹>

TROUBLE-SHOOTING PROGRAM (5)

V

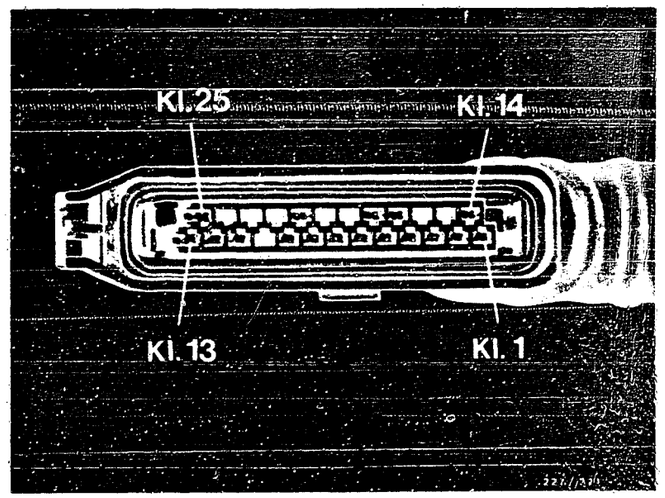
ENGINE-SPEED REFERENCE-MARK SENSOR
Test insulation.
Disconnect EI control-unit plug,
connect ohmmeter to term. 7
and term. 20.

Ohmmeter should show infinite
Ω .

Is resistance O.K.?

N>

Separate plug connection of
engine-speed reference-mark
sensor.
If resistance is now O.K.,
replace the engine-speed
reference-mark sensor.
If the resistance is not O.K.,
replace shielded lead from plug
connection to EI control unit.



EI control-unit plug

V

Continued on next picture page

B13 — <⟹>

B14 — <⟹>

TROUBLE-SHOOTING PROGRAM (5) CONTINUED (1)

V

ENGINE-SPEED REFERENCE-MARK SENSOR
Test internal resistance.

Connect ohmmeter to EI control-unit plug term. 7 and term. 19. See brief instructions for resistance.

Is resistance O.K.?

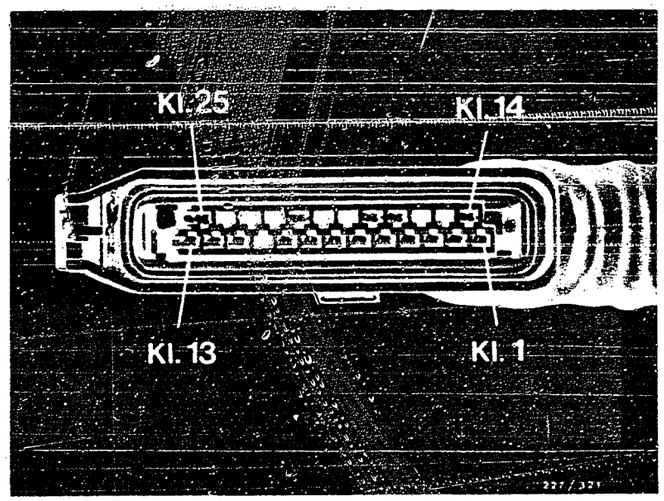
N>

Test engine-speed reference-mark sensor plug connection (damage, oxidation).
Connect ohmmeter in turn to:

EI control-unit plug		Plug of engine-speed reference-mark sensor
Term. 7	and	Term. 7
Term. 19	and	Term. 19

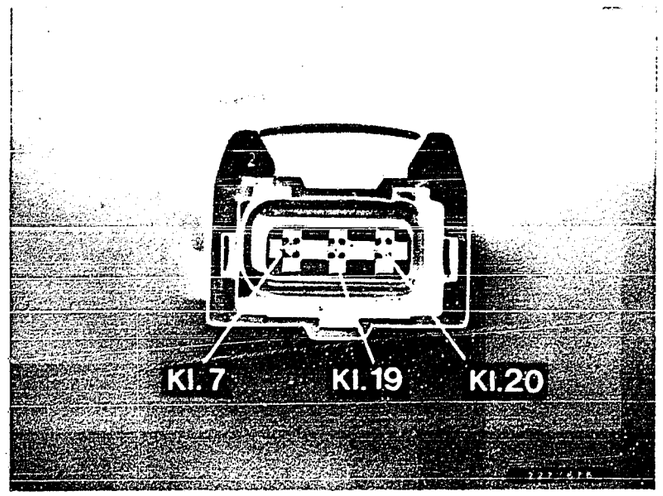
Ohmmeter reading should be approx. 0 Ω (continuity).

If there was no open circuit, replace the engine-speed reference-mark sensor.



EI control-unit plug

Plug for engine-speed reference-mark sensor



V

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (5) CONTINUED (2)

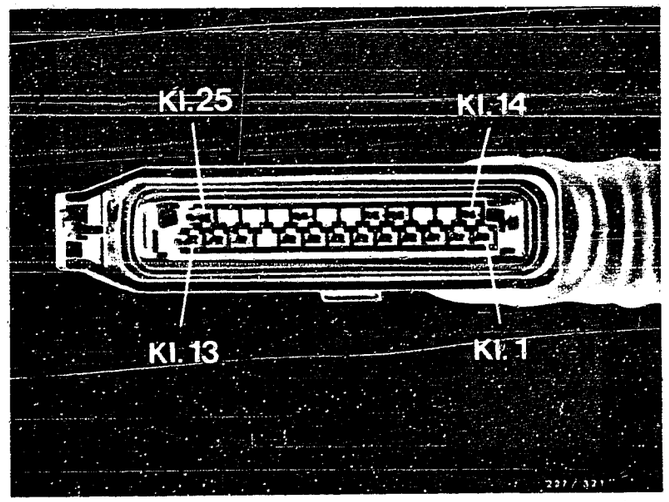
ENGINE-SPEED REFERENCE-MARK SENSOR
Test voltage.

Connect oscilloscope in accordance with operating instructions with program switch in "Special" position.
For example, MOT 201:
Connect red and black terminals to EI control-unit plug term. 7 (+) and term. 19 (-).
Start engine.
Oscilloscope should show an engine-speed-signal voltage of at least 2.5 V, see lower illustration.
Is engine-speed signal (voltage) O.K.?

N> Replace engine-speed reference-mark sensor.

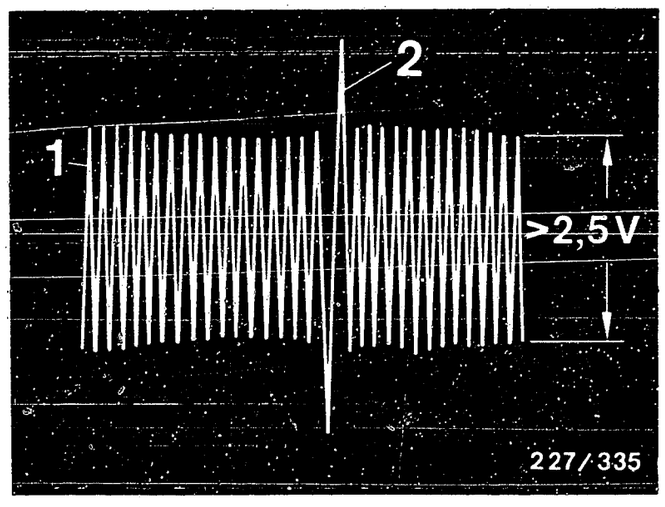
Y

Return to trouble-shooting chart B03



EI control-unit plug

1 = Engine-speed signal
2 = Reference-mark signal



TROUBLE-SHOOTING PROGRAM (6)

Test HIGH-VOLTAGE DISTRIBUTOR SETTING.

Remove the cap and dust-protection cover from the high-voltage distributor.
Set cylinder 1 to TDC.

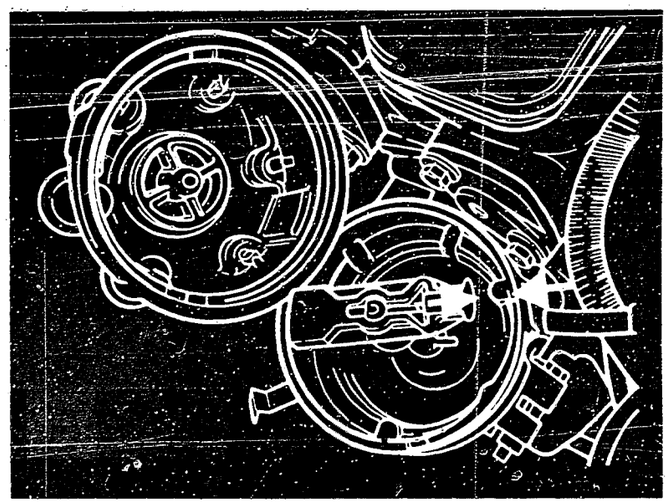
The distributor rotor must be positioned so that the middle of the distributor-rotor electrode is pointing at the housing marking for cylinder 1, see illustration.

Is high-voltage distributor adjustment O.K.?

N> Adjust high-voltage distributor.

Y

Return to trouble-shooting chart B03



TROUBLE-SHOOTING PROGRAM (7)

V

Test CONTACT RESISTANCES.

Disconnect negative and positive cables from battery. Disconnect EI control-unit plug.
Disconnect supply relay and relay frame term. 30 and connect both terms. 87 with auxiliary cable (bridge).
Switch on ignition.

1. Test leads from battery positive to EI control-unit plug term. 25 as well as leads from battery negative to EI control-unit plug term. 12 for contact resistance.
Maximum total contact resistance 0.3 Ω (take into account resistance of test leads and prods).

2. Test leads from battery positive to ignition coil term. 15 and from ignition coil term. 1 to EI control-unit plug term. 1 for contact resistance.
Maximum total contact resistance 0.3 Ω (take into account resistance of test leads and prods).

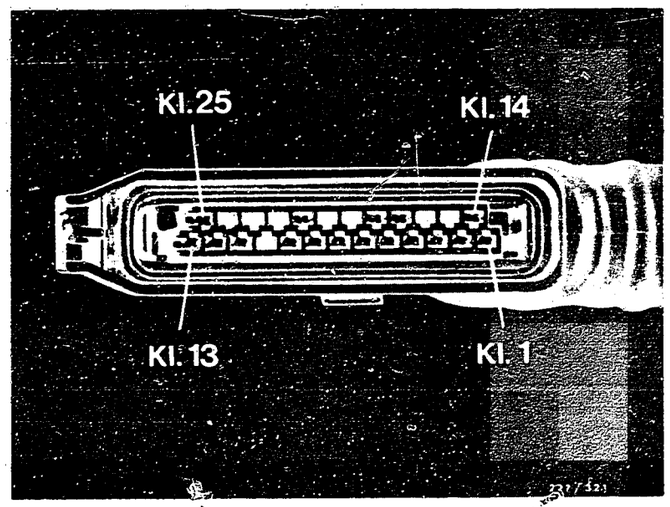
Resistance values for tests 1 and 2 O.K.?

N> Eliminate contact resistances.

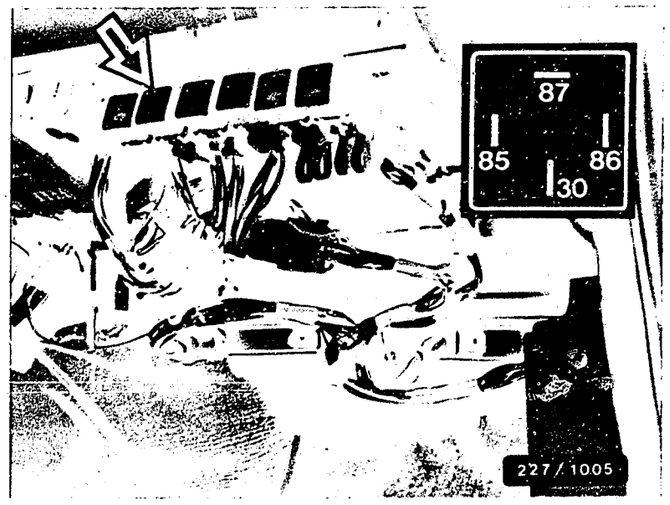
Y

V

Return to trouble-shooting chart B03



Arrow=Supply relay, ignition



TROUBLE-SHOOTING PROGRAM (8)

Test COOLANT-TEMPERATURE SENSOR.

Disconnect EI control-unit plug, connect ohmmeter to terms. 23 and 12.

See brief instructions for resistance values.

Was the resistance O.K. at the given coolant temperature?

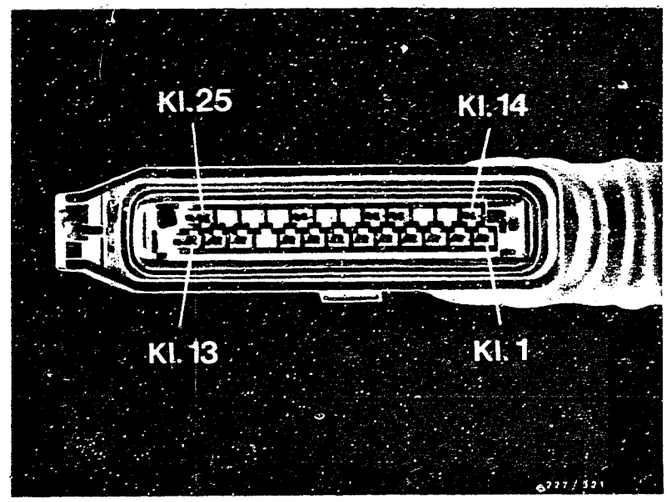
N>

1. If reading was infinite Ω connect ohmmeter to coolant-temperature-sensor plug term. 23 and EI control-unit plug term. 23, see illustrations. Ohmmeter should show approx. 0 Ω (continuity). Eliminate open circuit.

2. Resistance not within tolerance range: replace coolant-temperature sensor.

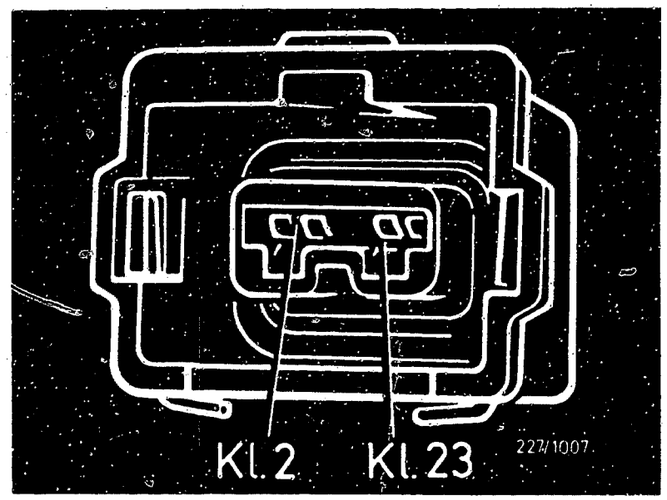
Y

Return to trouble-shooting chart B03



EI control-unit plug

Plug, coolant-temperature sensor



TROUBLE-SHOOTING PROGRAM (9)

Test THROTTLE-VALVE SWITCH, IDLE.

Disconnect LH-Jetronic and EI control-unit plugs.
Connect ohmmeter to EI control-unit plug terms. 4 and 12, see upper illustration.
Ohmmeter should show approx. 0 Ω with throttle valve in idle position. Open throttle plate approx. 1°. Ohmmeter should show infinite Ω .

Resistance values O.K.?

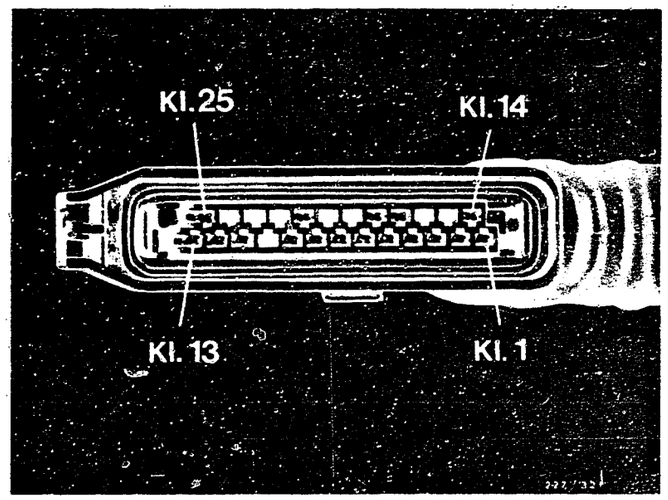
N>

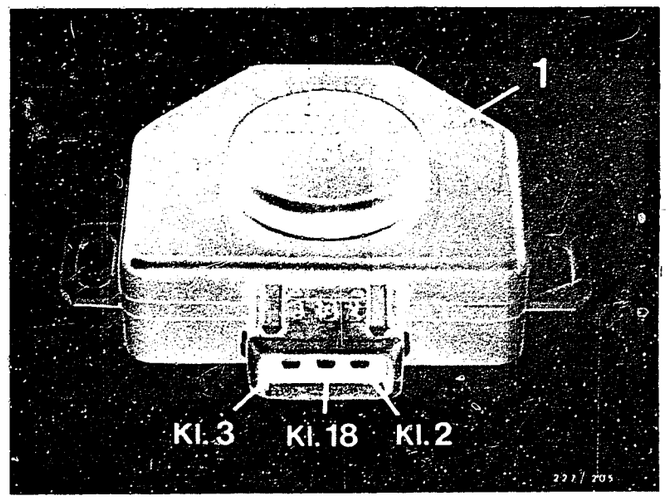
1. Disconnect throttle-valve-switch plug.
Connect ohmmeter in turn to:

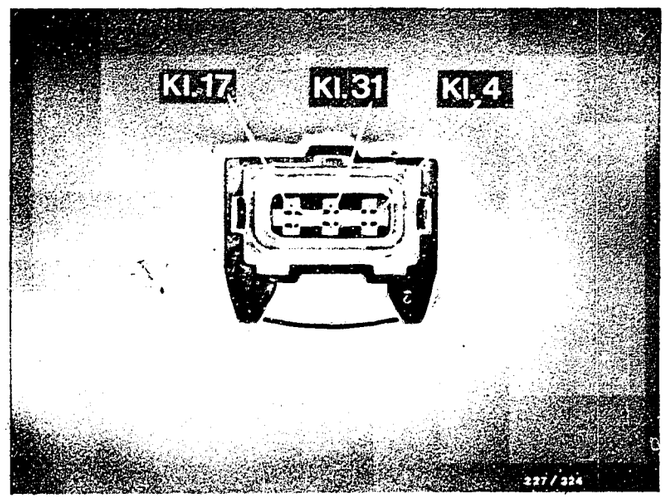
Throttle-valve-switch plug		EI control-unit plug
Term. 4	and	Term. 4
Term. 31	and	Term. 12

Ohmmeter should show approx. 0 Ω (continuity).
Eliminate open circuits.

2. Connect ohmmeter to throttle-valve switch terms. 2 and 18. Ohmmeter should show approx. 0 Ω with throttle plate closed.
Open throttle plate about 1°.
Ohmmeter should show infinite Ω .
If resistance values not O.K., adjust or replace throttle-valve switch.







Continued on next picture page

TROUBLE-SHOOTING PROGRAM (9) CONTINUED (1)

Test THROTTLE-VALVE SWITCH, FULL LOAD.

Connect ohmmeter to EI control-unit plug terms. 17 and 12, see upper illustration.

Open throttle plate fully.
Ohmmeter should show approx. 0 Ω .
Close throttle plate.
Ohmmeter should show infinite Ω .

Is resistance O.K.?

N>

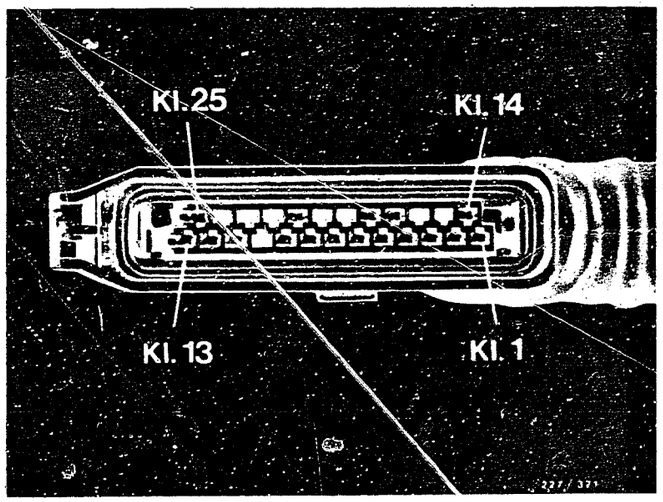
1. Disconnect throttle-valve-switch plug.
Connect ohmmeter in turn to:

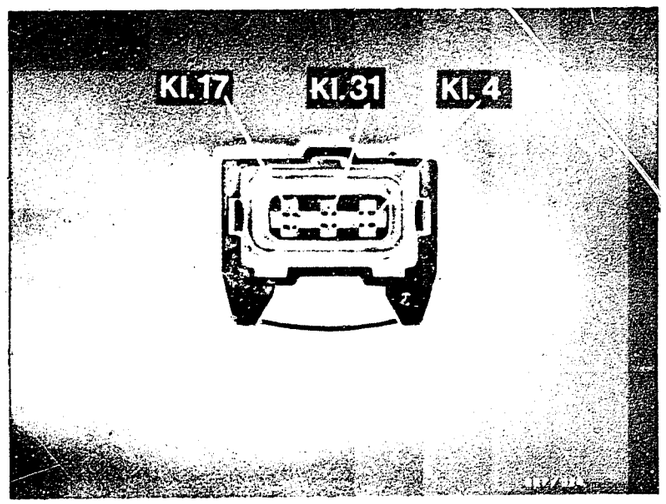
Throttle-valve-switch plug		EI control-unit plug
Term. 17	and	Term. 17
Term. 31	and	Term. 12

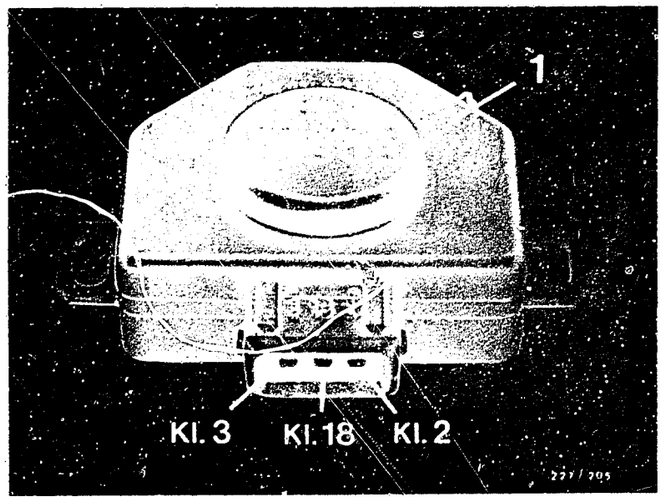
Ohmmeter should show approx. 0 Ω (continuity).
Eliminate open circuits.

2. Connect ohmmeter to throttle-valve switch terms. 3 and 18.
Open throttle plate fully.
Ohmmeter should show approx. 0 Ω (continuity).
If resistance values not O.K., replace throttle-valve switch.

Return to trouble-shooting chart B03







TROUBLE-SHOOTING PROGRAM (10)

V

Test VACUUM CHANGE-OVER.
(Only EU model without catalytic converter)

Disconnect time-limit-switch plug (upper illustration) and connect voltmeter to term. 3 (-) and term. 1 (+).
Switch on ignition.
Voltmeter should show approx. battery voltage.

Is voltage O.K.?

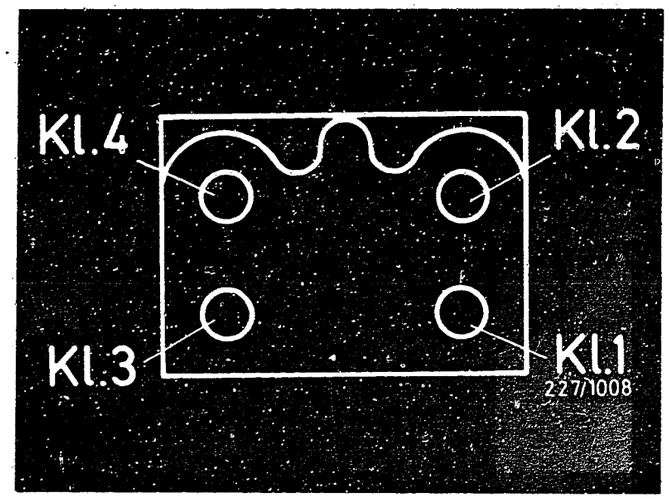
N>

Switch off ignition.
Connect ohmmeter in turn to:

1. Trigger box plug		Supply-relay frame
Term. 1	and	Term. 87

2. Trigger box plug		Vehicle ground
Term. 3	and	Term. 31

Ohmmeter should show approx. 0 Ω (continuity) each time.
Eliminate open circuits.



Y

V

Test VACUUM CHANGE-OVER (continued)

Disconnect trigger-box plug and connect ohmmeter to terms. 3 and 4.

See table for resistance values.

Coolant temperature	Resistance
< approx. 38°C	approx. 0 Ω
> approx. 45°C	infinite Ω

Is resistance O.K. at given coolant temperature?

N>

Test lead from trigger-box plug term. 4 to temperature sensor term. 4 for open circuits.
Eliminate open circuits.

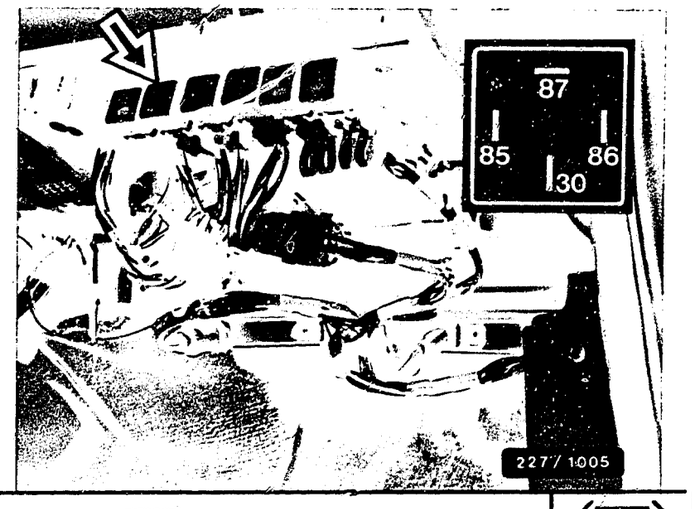
If there was no open circuit, replace the temperature switch.

Y

V

Continued on next picture page

Arrow=Supply relay, ignition



TROUBLE-SHOOTING PROGRAM (10) CONTINUED (1)

V

Testing VACUUM CHANGE-OVER (continued)

Disconnect blue-green cable from temperature switch and connect to vehicle ground with auxiliary cable. Connect voltmeter to 3-way solenoid-operated valve term. 1 (+) and term. 2 (-). Switch on ignition. Voltmeter should show battery voltage.

Is voltage O.K.?

N>

Switch off ignition. Test following leads for open circuits:

1. From time-limit-switch plug term. 2 to 3-way solenoid-operated valve term. 2 (violet-white cable).

2. From 3-way sol.-op. valve term. 1 to supply-relay frame term. 87

Eliminate open circuits. If there were no open circuits, replace the time-limit switch.

Y

V

Testing VACUUM CHANGE-OVER (continued)

Connect ohmmeter to 3-way solenoid-operated valve terms. 1 and 2, see illustration.

Ohmmeter should show 30... 50 Ω .

Resistance O.K.?

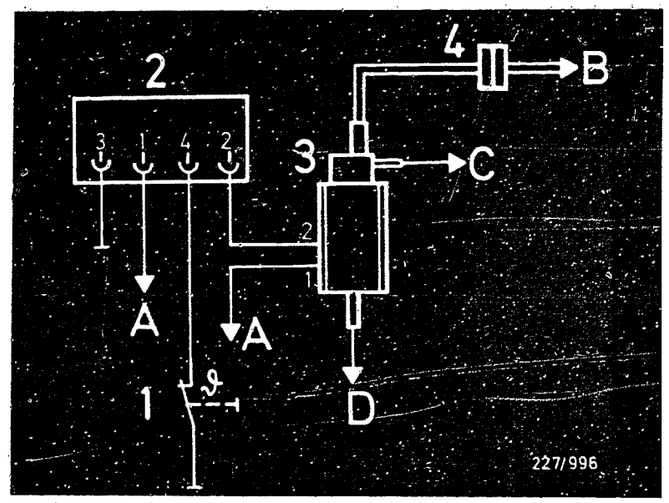
N>

Replace 3-way solenoid-operated valve.

Y

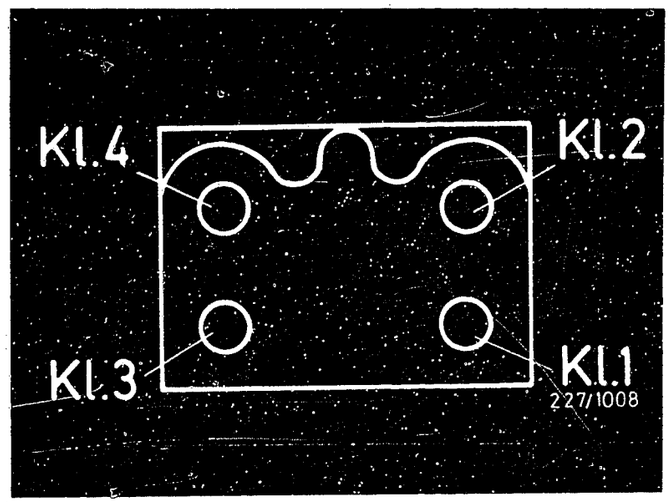
V

Continued on next picture page



1 = Temperature switch
2 = Time-limit switch
3 = 3-way solenoid-operated valve
4 = Delay valve
A = Voltage supply, term. 15
B = To throttle-valve assembly
C = To EI control unit
D = To intake manifold

Time-limit-switch plug



TROUBLE-SHOOTING PROGRAM (10) CONTINUED (2)

Testing VACUUM CHANGE-OVER (continued)

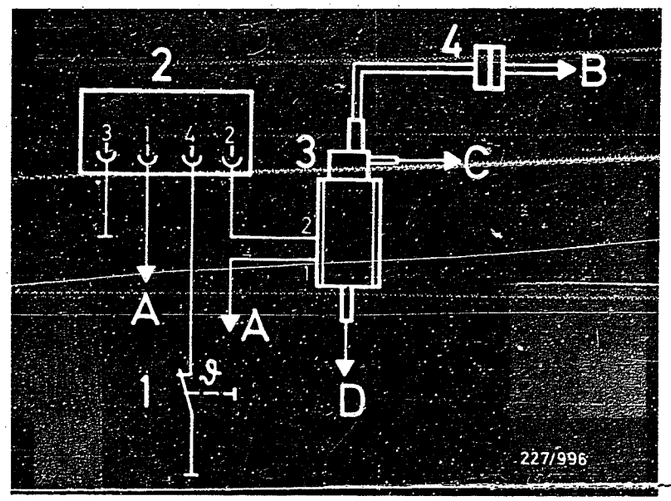
Disconnect throttle-valve-switch plug.
Run engine at idle, read off ignition timing.
Disconnect blue-green cable from temperature switch and connect to vehicle ground using auxiliary cable.
The ignition timing previously determined should be "RETARDED".

Has ignition point been "ADVANCED"?

N> Replace 3-way sol.-op. valve.

Y

Return to trouble-shooting chart B03



1 = Temperature switch
2 = Time-limit switch
3 = 3-way solenoid-operated valve
4 = Delay valve
A = Voltage supply, term. 15
B = To throttle-valve assembly
C = To EI control unit
D = To intake manifold

C05 —— <⟹>

C06 —— <⟹>

TROUBLE-SHOOTING PROGRAM (11)

V

Testing spark advance

(If test equipment shows obvious incorrect reading of engine speed, connect series resistor in series.) Run engine at idle at operating temperature. (600...700 min $^{-1}$).
The spark advance should be 5...11° before TDC.

N>

Repeat test step. Is idle speed (600...700 min $^{-1}$) O.K. and is throttle-valve switch idle contact closed?
If idle speed and throttle-valve switch idle contact are O.K. replace the EI control unit.

Is spark advance O.K.?

Y

V

Return to trouble-shooting chart B03

C07 — <⟹>

C08 — <⟹>

TROUBLE-SHOOTING PROGRAM (12)

Testing vacuum sensor

Disconnect throttle-valve-switch plug.
Disconnect vacuum hose from intake manifold (upper illustration). Connect vacuum pump to vacuum hose.
Operate engine at idle at operating temperature.
Read off spark advance.

Using vacuum pump, generate a vacuum of about 400 mbar. The spark advance should be "advanced"; at the same time the engine speed may change.

Is spark advance "advanced"?

N>

Disconnect vacuum hose from EI control unit and tightly seal (for example with a tapered drift, etc.)

Using a vacuum pump generate a vacuum of approx. 600 mbar. The vacuum must not change noticeably.
Eliminate any leakage (hose connection, line).
On EU model without cat. converter, the 3-way solenoid-operated valve of the vacuum change-over must also be checked for poor sealing or damage.

If there was no leakage, replace the EI control unit.

Y

Return to trouble-shooting chart B03

C09 — <⟹>

C10 — <⟹>

TROUBLE-SHOOTING PROGRAM (13)

V

Test VOLTAGE SUPPLY,
EI CONTROL UNIT.

Switch off ignition.
Disconnect EI control-unit plug and push handle cover back after unscrewing the fastening screws and removing the rubber seal.
Connect EI control-unit plug, see upper illustration.

Connect voltmeter to term. 25 (+) and term. 12 (-).
Run engine at idle.

Voltage should be 12...14 V and may lie a maximum of 1 V below battery voltage.

Is voltage O.K.?

N>

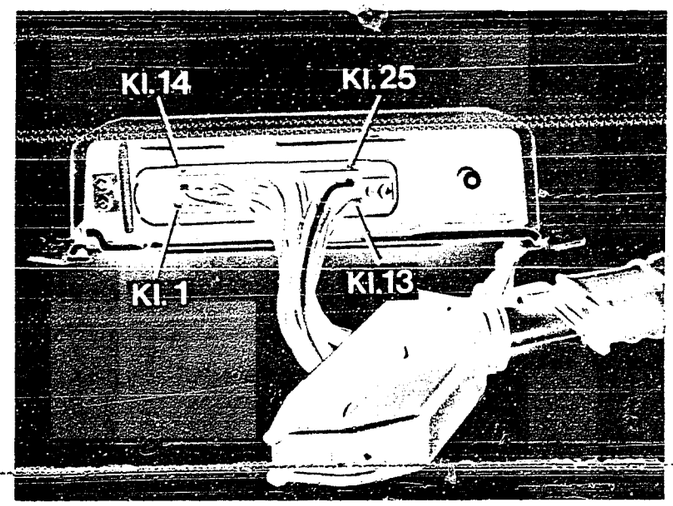
Disconnect negative and positive cables from battery, disconnect EI control-unit plug, disconnect supply relay (blue pin base), bridge term. 30 and both terms. 87 with auxiliary cable.
Switch on ignition.

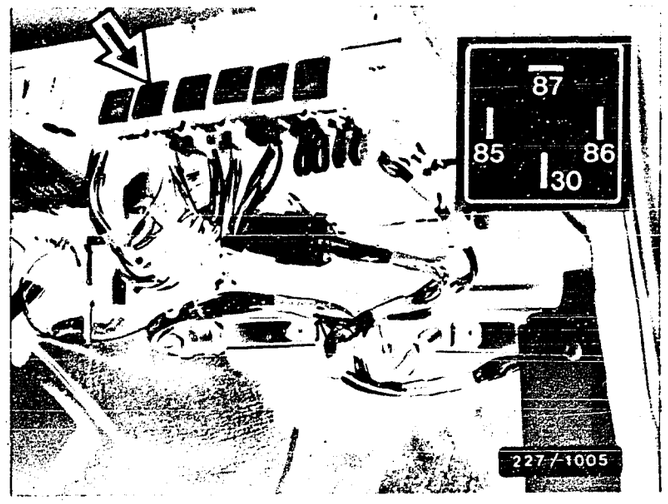
Test leads from positive battery terminal to EI control-unit plug term. 25 as well as leads from negative battery terminal to EI control-unit plug term. 12 for contact resistance.
Maximum total contact resistance 0.3 Ω (take into account resistance of test lead and prods).
Eliminate contact resistance.

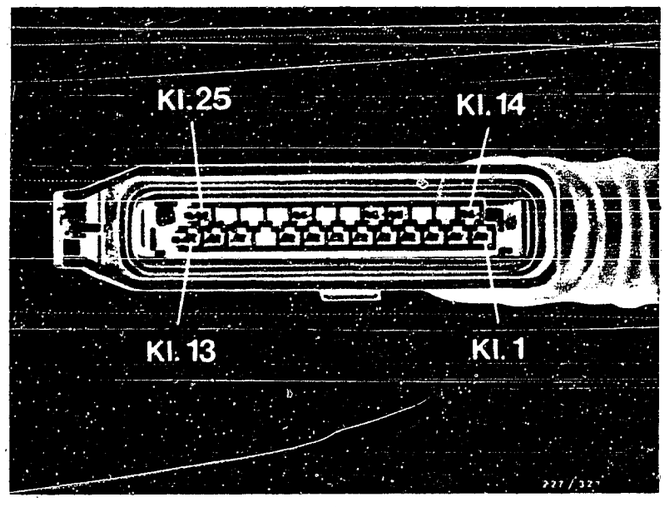
Y

V

Return to trouble-shooting chart B03







TROUBLE-SHOOTING PROGRAM (14)

V

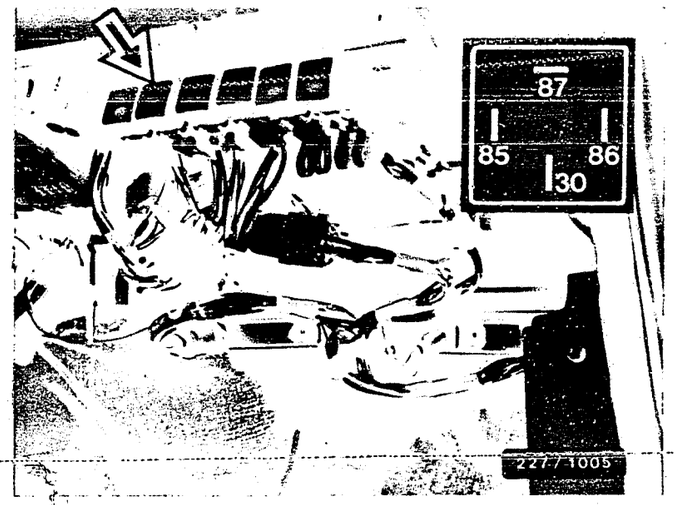
Test VOLTAGE SUPPLY, IGNITION COIL.

Connect voltmeter to ignition coil term. 15 and vehicle ground.
Run engine at idle.
The measured voltage must be at least 10 V.

Is voltage O.K.?

N> Disconnect positive cable from battery, disconnect supply relay (blue pin base), bridge term. 30 and both terms. 87 with auxiliary cable. Test leads from positive battery terminal to ignition coil term. 15 for contact resistance.
Maximum total contact resistance 0.3 Ω (take into account resistance of test lead and prods).

Eliminate contact resistance.



Arrow=Supply relay, ignition

Y

V

Return to trouble-shooting chart B03

C13 — <⟹>

C14 — <⟹>

TROUBLE-SHOOTING PROGRAM (15)

Test PRIMARY VOLTAGE.
(Where MOT series is available)

N> Replace EI control unit.

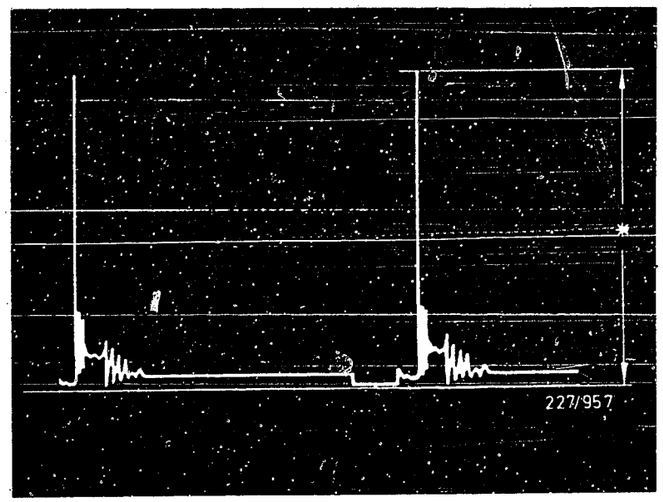
Connect oscilloscope (e.g. MOT 201) and pulse shaper 1 684 463 154 in accordance with operating instructions.
NOTE: If no pulse shaper is used the measured value will be incorrect.
Run engine at idle. See brief instructions for primary voltage set value.

Is voltage O.K.?

Y

Return to trouble-shooting chart B03

* = See Brief Instructions



TECHNICAL BULLETIN

|22|

DANGER OF ACCIDENT ON SEMI-CONDUCTOR IGNITON SYSTEMS

VDT-I-227/102 En
03.1981

Supersedes Feb. 3, 1976 edition

Please be sure to pass this bulletin together with VDE 0104/7.67 enclosed on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufacturers starting to equip their vehicles with semi-conductor ignition systems as original equipment.
In most cases, the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" components or terminals (whether on the primary side or the secondary side) can prove fatal.

In this connection, we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems, the ignition is to be switched off.
Included in such work are the following operations:

* Connection of engine testing equipment (timing strobe, dwell-tach tester, ignition oscilloscope etc.)
* Replacement of ignition system components (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.)

NO1 ⟹

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor, for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at the individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnositc connector), on terminals, and on test equipment.

In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

* Operation of the trigger box without the ignition transformer.

* At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the dangerous locations being marked with high-voltage arrows.

We would point out that all semi-conductor ignition systems, even the older versions, are to be regarded as dangerous in the sense as defined by this bulletin.

NO2 ⟸⟹

1 = Battery
2 = Ignition lock
3 = Trigger box
4 = Resistor
5 = Ignition distributor
6 = Ignition coil
7 = To starting motor term. 1b
8 = To tachometer connection
or diagnostic plug
or TD connection

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

TECHNICAL BULLETIN

EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS
e.g. Ignition systems, Jetronic, Motronic, ABS

VDT-I-227/107 En
01.1981

Please ensure that this Bulletin is passed on to your employees for their attention.

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) published the results.

The most important discoveries in this practice can be summarized from the examination report as follows:

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.

2. With a stationary engine and the ignition switched off, the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.

3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency). Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.

4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers, please introduce the necessary measures.

We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

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Robert Bosch GmbH
Division KH
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TECHNICAL BULLETIN

NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En
01.1983
Supersedes 5.1981 edition

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Coil ignition	ZS (CI)	———	Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I * (TCI-i)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)
	TSZ-H (TCI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)
Transistorized ignition	TZ-I * (TI-i)	I-Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in hybrid technique)	TZ-H * (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Breakerless semi conductor ignition with or without knock control	EZ (EI) (EZ-K) (EI-k)	——— K= Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributor-less ignition with or without knock control	VZ (FEI) VZ-K (FEI-k)	——— K= Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

* Note:

The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).

Published by:

Robert Bosch GmbH
Division KH
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concerning the contents to our authorized
representative in your country.

INCORRECT DISPLAY OF ROTATIONAL SPEED AND DWELL ANGLE ONLY WITH TRIGGER BOXES 0 227 100 .. (TCI-i, TCI-h) WITH CURRENT LIMITATION

VDT-I-Gen. 030 En
02.1981
Supersedes ed. 6.1980

For additional information, see VDT-I Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00	Rotational-speed	KTE 001.00
001.01	display O.K. with	001.02
001.02	these testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan Datsun	(Hitachi ignition system)
Fiat	(Delco ignition system)	Peugeot	(Bosch ignition system)
Ford	(Delco ignition system)	VW	(Bosch/Fairchild ignition system)
General Motors	(HEI ignition system)	Bosch transistorized ignition system for retrofitting 0 227 100 920	

2. Test instructions

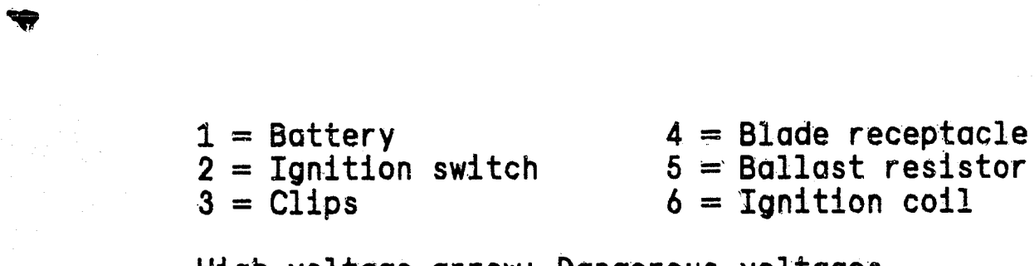
2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min^{-1} to 1200 min^{-1}).

It is, however, possible to attain correct rotational-speed measurements:

Connect a ballast resistor of 0.9 or 1.0 Ohms (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.



High-voltage arrow: Dangerous voltages (400 V – 25 kV)

Suggestion for user manufacture

Required parts:

1 ballast resistor 0.9 Ohms	Part no. 0 227 900 002
or	
1 ballast resistor 1.0 Ohms	Part no. 0 227 900 101
2 blade receptacles	Part no. 1 901 355 881
e.g. approx. 0.2 m cable, 1.5 mm^2 e.g.	Part no. 6 210 150 150
2 insulated clips	Commercially available

2.2 Dwell angle

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

2.3 Ignition point

Is displayed correctly. Connect tester as per operating instructions.

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MOTOR VEHICLE SERVICE INFORMATION

MOTORTESTER CONVERSION VDT-I-Gen. 032 En
Incorrect display of rotational speed, 06.1980
dwell angle and ignition point
only with trigger boxes
0 227 100 .. (TCI-i, TCI-h) with current limitation

For additional information, see
VDT-I-Gen. 030 of 6.80
Re.: Motortesters EFAW 268
268 S 10 ●
269
214 B
AE 2000

1. General

Please make sure that the above-mentioned motortesters in your workshop and at your customers (e.g. motor-vehicle workshops, oil companies, gas stations, vocational schools etc.) are converted. The conversion is subject to payment and is carried out by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with fitting of switch).

2. Why motortester conversion?

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage charactistics. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle as well as to incorrect triggering of the meter when testing the ignition system.

There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing strobe is triggered by the signal-path dwell-angle meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing strobe is triggered by the clamp-on induction pickup and the pulse shaper stage.

a = Clamp-on induction pickup
b = (Extract from WJF 508/1, Page 53)

EFAW 268, 268 S 10, 269, AE 2000

Remove the line of the ZLP from pin 31 of printed board 11 (coupling stage) and connect to pin 30 of printed board 15 (pulse shaper stage) via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 11 to the other contact of the switch with change-over contact.
Arrow points to switch with change-over contact.

(Extract from WJF 503/1, Page 64))

EFAW 214 B

Remove the line from terminal 6 of printed board 16 to pin 31 of printed board 2 (coupling stage) and connect to pin 24 of the same printed board via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 2 to the other contact of the switch with change-over contact.

Arrow points to switch with change-over contact.

By fitting the switch with change-over contact in the front panel of the motortester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly:
e.g. "Standard" – "Current limitation".
These conversion measures have already been published in the K7 information sheet KJF 28/7911.

4. Test instructions

4.1 Standard ignition systems

Switch position: "Standard".
All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "Current limitation".
In order to trigger the timing strobe, the inducation-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

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TESTS ON ELECTRONIC IGNITION SYSTEMS (TCI, TI)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
03.1981

The following tests are listed in older and current Tester operating instructions or in "Trouble-shooting with the oscilloscope":

* "Separate ignition coil test"
 (Concerns EFAW 213, 214, 268, AE 2000)

* Calculating the "ignition voltage reserve"
 (Concerns EFAW 213, 214, 268, AE 2000 and MOT series).

* "Intensified insulation test"
 (Concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays, transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ingition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should n o t be carried out on transistorized ignition systems.
The contents of this Service Information has already been published in the K7 Information K7-VJF 17/8012.

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IMPRESSUM

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